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between 3.05–3.10, and its extinction between  $15^{\circ}40'$  and  $17^{\circ}15'$ . The analysis of the blue variety yielded :

SiO <sub>2</sub>	FeO	MnO	MgO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	H <sub>2</sub> O	F = Total
56.25	.15	6.49	21.89	5.44	6.17	1.60	1.56	.15 = 99.70

The second, *adelite*, occurs at Langban and at Nordmark in mass of a gray color, with a hardness of 5 and a density of 3.76. Its analysis leads to the formula  $2\text{CaO}, 2\text{MgO}, \text{H}_2\text{O}, \text{As}_2\text{O}_5$ . The third, *svabite*, is probably an apatite. It is found in colorless hexagonal prisms at Harstig Mine, Pajsberg.  $a : c = 1 : .7143$ . Composition =  $\text{H}_2\text{O}. 10\text{CaO}. 3\text{As}_2\text{O}_5$ .

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## BOTANY.

**The Sargasso Sea.**—In a recent number of Petermann's 'Mittheilungen' Dr. O. Krümmel states the result of his investigations into this interesting marine problem. In the first place, he differs entirely from Humboldt as to the shape of the floating mass of vegetation. The "great bank of Flores and Corvo" is, he says, Humboldt's summing up of the observations made by sailing-vessels passing through the Sargasso Sea on their way from the Southern hemisphere to Europe. These followed with slight variations the same course, and their observations were naturally limited in extent. It was on these insufficient data that Humboldt founded his theories as to the size and shape of the Sargasso Sea, but now, by the aid of steam, we are able to arrive at more correct conclusions on these points. On a map which he has prepared Dr. Krümmel has plotted out the general contour of the mass of floating vegetation, and has indicated in what parts of the sea the sargasso is found in the greatest abundance. In shape the Sargasso Sea is a sort of ellipse, the great axis of which almost coincides with the Tropic of Cancer, while the two foci are near long.  $45^{\circ}$  and  $70^{\circ}$  West. Around this central ellipse others are indicated, larger in size, but with the vegetation much less dense. In their general outline they follow with sufficient nearness the course of the prevailing winds. As to the origin of the algæ, Dr. Krümmel is strongly of the opinion that they come from the land—not only from the Gulf of Mexico and the coast of Florida, but from the shores of the Antilles and the Bahamas. The most recent studies with regard to the origin and course of the Gulf Stream tend, he thinks, strongly to support those who assert that the algæ come from the land, and to disprove the contention of those

who support the hypothesis of a marine origin. Now that it is settled that the Gulf Stream is not a single narrow stream issuing from the Gulf of Mexico, but an accumulation of converging currents sweeping past the coasts of the Antilles and through the adjoining seas, it is obvious that the quantity of algæ carried away must be much greater than it could have been were the old hypothesis of the origin of the Gulf Stream correct. Dr. Krümmel makes an approximate calculation as to the time occupied by the algæ in reaching the Sargasso Sea. A fortnight after reaching the Gulf proper, the weed would, at the rate of two knots an hour, reach the latitude of Cape Hatteras. From that point its onward motion is slower, and it takes about five months and a half for it to reach west of the Azores. After reaching the Sargasso Sea the weed continues to move slowly, until, becoming heavier as it grows older, it gradually sinks to make way for fresh supplies. (Proceeds. Roy. Geog. Soc., Oct., 1891.)

**Ferns of the Black Hills.**—Last July while collecting in the Black Hills of South Dakota the following ferns were recorded. My collecting field was in the central portion of the Hills in the vicinity of Harney's Peak. About the same time Professor Williams of Brookings, S. D. visited the eastern part of the Hills, and made a few notes which I add to mine. This list is interesting inasmuch as it is much larger than any yet made for this region, including several species not hitherto known to grow this far west.

*Polypodium vulgare* L.—Abundant on the rocks in and about Harney Glen, on the side of Harney's Peak.

*Adiantum pedatum* L.—Reported on good authority from near Hot Springs, but no specimens were secured.

*Pteris aquilina* L.—Specimens were seen, but not collected, between Hill City and Deadwood.

*Cheilanthes lanuginosa* Nutt.—On the rocks at Custer; Professor Williams collected it at Rapid City, also.

*Pellaea atropurpurea* Link.—On the rocks at Custer. Collected at Rapid City also by Professor Williams.

*Asplenium trichomanes* L.—On the rocks at Custer, and in the ravines on Harney's Peak.

*Asplenium septentrionale* Hoffm.—In the crevices of rocks at Custer, and in Harney Glen. This is a most curious fern, resembling a tuft of grass.

*Asplenium filix-femina* Bernh.—On moist soil at Custer.

*Phegopteris dryopteris* Fee.—In a bog in Harney Glen.

*Aspidium filix-mas* Swartz.—In moist places in Harney Glen.

*Aspidium filix-mas* Swartz, var. *incisum* Nutt.—What I take to be this variety was collected in Harney Glen. It differs from the preceding in having more incised pinnules, and in being freer from chaff on the rachis.

*Cystopteris fragilis* Bernh.—In shaded places near rocks at Custer. The specimens collected were covered with a fine rust, *Uredo polypodii* (P.) D. C.—This fern was collected at Rapid City, also by Professor Williams.

*Onoclea sensibilis* L.—In shaded thickets on the sides of Buckhorn Mountain, and in ravines approaching Harney's Peak.

*Onoclea struthiopteris* Hoffm.—In cañon of Rapid Creek near Rapid City (Professor Williams).

*Woodsia oregana* D. C. Eaton.—Collected at Rapid City by Professor Williams.

*Woodsia scopulina* D. C. Eaton.—Common in the crevices of rocks at Custer.

*Botrychium virginicum* Swartz.—Collected at Rapid City by Professor Williams, who reports it to be rare.—CHARLES E. BESSEY.

**Notes on the Flora of Western South Dakota.**—(*Concluded from p. 63.*)—The time spent in the Black Hills region was too short to enable one to form any very accurate ideas regarding its large and varied flora. There is a mixture of Rocky Mountain forms with those of the astern flora, which with the prairie forms make the Black Hills flora a very interesting one. The cañons are pleasing fields to the student. Working up one cañon we find in a shady nook *Lophanthus anisatus*; on the drier flats are many kinds of *Eupatorium* and *Aster*, and an abundance of *Argemone platyceras*, while on several shady banks *Onoclea struthiopteris* grows as tall as a man's head. Up a small side cañon are found *Potentilla fruticosa*, *Physocarpus monogynia*, *Arctostaphylos uva-ursi*, *Disporum trachycarpa*, and *Shepherdia canadensis*. Out into another and darker side cañon, and we see *Pyrola secunda*, *P. chlorantha*, *Maianthemum canadense*, *Pterospora andromeda*, along the dry bottom of another *Mentzelia oligosperma*, *Geranium richardsonii*, *G. carolinianum* and *G. dissectum* were collected. Far up a narrow, dark gorge grows *Mimulus luteus* with *Corylus rostrata* on the bank above. Along the higher bluffs, *Pinus ponderosa* var. *scopul-*

orum makes the greater part of the timber, but lower down in the cañons are *Betula papyrifera*, *B. occidentalis*, *Ostrya virginica*, both the junipers, *Fraxinus viridis*, *F. pubescens*, *Populus monilifera*, *P. tremuloides*, *Ulmus americana*, and *Quercus macrocarpa*. This last has a number of very interesting and perplexing forms. *Ribes gracile*, *R. aureum*, *R. floridum* are very plentiful, and when we were there were loaded with fruit, all of which was quite palatable excepting that of *R. cereum*; cherries were also plentiful. *Rubus strigosus* was abundant in many places, and was loaded with fruit, which was ripe in August.

There are a great many introduced plants in the larger valleys, and a discussion of their introduction would be interesting were one better acquainted with them and their surroundings.

Quite a number of fungi were found here. Of the lichens I shall say nothing now except that the lichen flora is very interesting, and that I found many good things.

When we left the Black Hills for the Bad Land region we followed down a stream called Spring Creek. We had been told that there was considerable timber on the stream. Most of the way down, the wagon road is at the foot of the bluffs at some distance from the stream, and no trees could be seen. We concluded that we had been misinformed. By-and-by we turned to cross the stream and found that there was a second bottom between us and the stream, and that the real valley was hidden from our sight. This was covered with a fine growth of elm, ash, hackberry, boxelder, willow, etc. There is wood enough along this one stream to keep a whole county in wood if rightly used.

The Cheyenne Valley, at the mouths of Spring Creek and Indian Creek, differs but little from that in the vicinity of Smithville before mentioned.

By following up the Indian Creek Valley one can enter the Bad Lands proper in the vicinity of Sheep Mountain. This flora is also interesting. All the plants, excepting a few stunted introduced species are of the kinds adapted to a dry climate and poor soil. The chenopods are well represented by *Atriplex nuttallii*, *A. argentea*, *A. patula*, var. *hastata*, *Sarcobatus vermiculatus* and several species of *Chenopodium*. *Atriplex nuttallii* and *Sarcobatus vermiculatus* are most plentiful on the sterile sides of the buttes and hills, both becoming quite shrubby with age. The old stems are often well covered with several species of lichens. Along the sides of Sheep Mountain and some other of the more favored places *Juniperus virginiana* is quite

abundant. The valleys bordering the streams are sometimes quite well sodded with grass, but no species of much importance are found except in the larger valleys or in the basins. *Andropogon scoparius* is the commonest of these grasses. It is of no use at all as a forage grass, since stock will not eat it either green or as hay, and but few machines can be found that will cut it. In some of the larger basins *Bouteloua racemosa*, several species of *Calamagrostis*, *Spartina cynosuroides* and *S. gracilis* and *Panicum virgatum* are the principal forage plants.

The timber of the Bad Land streams consists chiefly of *Populus monilifera*, *Shepherdia argentea* and an occasional elm, box-elder or ash. *Physaria didymocarpa* is very common throughout the whole region, its thick, fleshy leaves reminding one of the large-leaved *Sedums*.

*Astragalus* is represented by *A. bisulcatus*, *A. sericoleucus*, *A. gracilis*, *A. missouriensis* and *A. caespitosus*. *Sophora sericea*, abundant all along the Cheyenne, gets up into the woodlands in many places. The Cacti are represented by *Opuntia rafinesquei*, *O. fragilis*, and *O. missouriensis*, in many puzzling forms, *Mamillaria vivipara* and *M. missouriensis*. All these are plentiful, *O. fragilis* and *O. rafinesquei* apparently preferring the higher table-lands and the others the basins and lower table-lands. *Rhus radicans* and *R. canadensis* var. *trilobata* occur in many places.

Almost in the centre of the Great Basin there is a veritable oasis. At the base of a long hill of considerable height there is a cluster of springs known as Iron Springs, from the peculiar taste of the water. The entire hill seems to be made of better soil than the surrounding country, for it is covered with a fine growth of grass, including many of the best species, as *Bouteloua racemosa*, *Andropogon furcatus*, *A. nutans*, *A. hallii* and *Panicum virgatum*. Here we also found *Eurotia lanata*, *Psoralea cuspidata*, *P. lanceolata*, *P. argophylla*, *P. digitata* and *P. tenuiflora*, *Aster multiflorus*, *Artemisia ludoviciana*, *A. longifolia*, *A. filifolia*, *Agropyrum glaucum*, *A. tenerum* and many other prairie species. Along the more abrupt sides of the hill grew *Celtis occidentalis*, *Juniperus virginiana*, *Populus balsamifera*, *P. monilifera*, *Ulmus americana*, *Prunus virginiana*, *P. americana*, *Acer negundo*, *Fraxinus viridis* and *F. pubescens*. In the immediate vicinity of the springs a great many plants were found that one would hardly expect. Some of the finest plums, either wild or cultivated, that I have ever eaten grew on bushes fringing the springs. Here also were elm, ash, blackberry, cherry, box-elder, willow, *Ampelopsis quinquefolia*, *Ribes aureum*, *R. floridum*, *R. gracile*, *Parietaria pennsylvanica*, *Symphoricarpos occi-*

*dentalis*, *Polygonum dumetorum* var. *scandens*, *Phryma leptostachya*, *Distichlis maritima*, *Lemna minor*, *L. polyrrhiza*, *Mimulus jamesii*, *Spartina cynosuroides* and *gracilis*, with other species common to prairie and timbered regions. Many of the species found at these springs were found no nearer than the Black Hills or the Missouri River, yet here they seemed to flourish in the very centre of the great Bad Land region.

I append a list of a few of the more characteristic species of each of the three regions.

THE RANGE. — *Stipa comata*, *Bouteloua hirsuta*, *Bouteloua oligostachya* and *B. racemosa*, *Agropyrum glaucum*, *A. repens*, *Yucca angustifolia*, *Sophora sericea*, *Shrankia uncinata*, *Psoralea argophylla*, *tenuiflora*, *cuspidata* and *esculenta*, *Astragalus caryocarpus* and *fleurosus*; *Gutierrezia euthamiae*, *Solidago missouriensis*, *canadensis* and *serotina*; *Helianthus petiolaris*, *Marsilia vestita*.

THE BLACK HILLS. — *Onoclea struthiopteris*, *Juniperus communis* and *virginiana*; *Picea alba*, *Pinus ponderosa* var. *scopulorum*, *Betula occidentalis* and *papyrifera*; *Erigeron salsuginosus*, *Ostrya virginica*, *Corylus rostrata* and *americana*; *Pyrola chlorantha* and *secunda*; *Pterospora andromeda*, *Androsace septentrionalis*, *Hedeoma drummondii*, *Lophanthus anisotus*, *Mimulus luteus* and *ringens*; *Shepherdia canadensis*, *Euphorbia dictyosperma*, *Sambucus canadensis* and *racemosa*; *Aralia nudicaulis*, *Actaea rubra* and *alba*; *Disporum trachycarpum*, *Geranium richardsonii*, *carolinianum* and *dissectum*; *Mentzelia oligosperma*, *Quercus macrocarpa*.

THE BAD LANDS. — *Spartina gracilis*, *Sporobolus airoides*, *Sporobolus asperifolius*, *Andropogon hallii*, *Physaria didymocarpa*, *Astragalus sericoleucus*, *Astragalus caespitosus*, *Astragalus gracilis*, *Astragalus pictus*, *Oenothera caespitosa*, *Sarcobatus vermiculatus*, *Atriplex nuttallii*, *Parmelia molliuscula*, *Urceolaria scruposa* var. *gypsacea*, *Ulceolaria scruposa*, var. *parasitica*, *Tylostoma mammosum*, *Geaster delicatus*.—

T. A. WILLIHMS.